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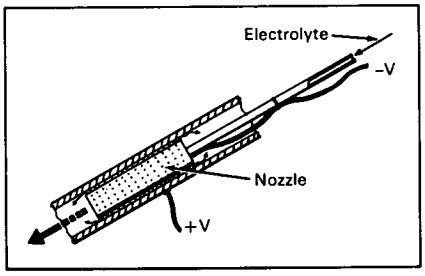
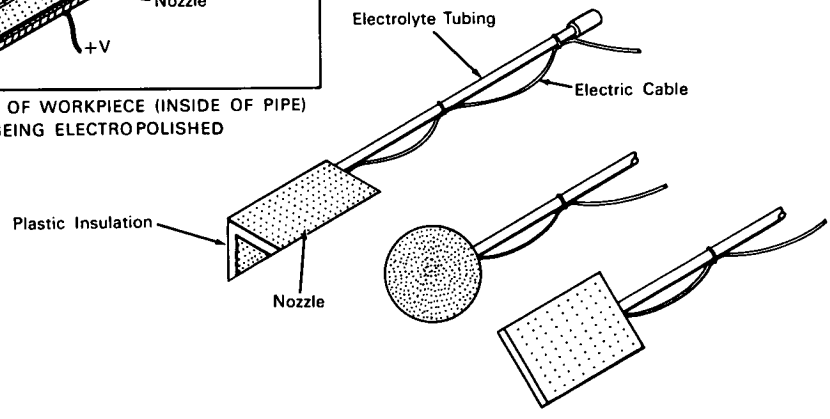
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Improved Technique for Localizing Electropolishing Features Novel Nozzles



SECTION OF WORKPIECE (INSIDE OF PIPE) BEING ELECTROPOLISHED



TYPICAL NOZZLE CONFIGURATIONS

The problem: Electropolishing has been used to remove high points on metal parts of irregular contour which would be difficult or impossible to buff. The conventional procedure of immersing the workpiece in a tank of electrolyte severely restricts the size and configuration of items which can be electropolished.

The solution: A technique by which impingement electropolishing is accomplished using an electrolyte film evenly distributed by a nozzle (cathode) specifically designed to match the contour of the workpiece (anode). The rate of movement of the nozzle or workpiece is determined by the material treated, electrolyte flow rate, supply voltage, temperature, and depth of electrolyte film (separation between nozzle and workpiece) which largely determines current density at the applied area.

How it's done: A nozzle made of stainless steel and copper, with configuration and holes suited to the workpiece to be treated, is electrically connected to the negative terminal of a dc generator. The workpiece is connected to the generator positive terminal. The nozzle is covered with an appropriate insulating material that is impervious to the electrolyte solution. A border, flange, or group of small pads (feet) of the same insulating material is attached to the face or rim of the nozzle in such a way that the optimum clearance

(continued overleaf)

between nozzle face and workpiece is achieved. Electrolyte flow is begun, the dc generator switch is closed, and the nozzle or workpiece is moved in such a manner that the electropolishing is accomplished in an even coverage. Normally, the nozzle would be moved although movement of the workpiece may be dictated by considerations of size, contour, etc. In the impingement electropolishing of stainless steels, the following operating parameters produced optimum results:

Temperature	Room to 130°F
Voltage	6–12 vdc
Time/Area	2–5 min/sq ft
Nozzle speed	12 ft/min
Electrolyte flow rate	1.0–1.5 gal/min

A solution of phosphoric, sulfuric, and chromic acids in water produced the best finishes and had no tendency to foam although current densities of 3000 amps per square foot were reached.

Notes:

1. Weldments can be greatly improved by this process although the parent materials need not be treated. Size of the welded items poses no problems for this technique.
2. This process should be useful in the food processing and chemical industries to increase corrosion resistance in welded areas and to reduce the pressure drop in piping or ducting.
3. A related innovation is described under NASA identification serial number WOO-059, October 1963. Inquiries may be directed to:

   Technology Utilization Officer
   Western Operations Office
   150 Pico Boulevard
   Santa Monica, California, 90406
   Reference: B64-10271

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: General Dynamics/Astronautics
under contract to Western Operations Office
(WOO-101)